

# Microgrid Modeling, Planning and Operation

**Wencong Su**

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science

In

Electrical Engineering

Virgilio A. Centeno, Co-Chair

Yilu Liu, Co-Chair

Richard W. Conners

November 18th, 2009

Blacksburg, Virginia

Keywords: Distributed Generation, Microgrid, MATLAB/SIMULINK, Simulation

Copyright© 2009, Wencong Su

**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 1-1. CESI RICERCA DER test facility "Pilot Microgrid Projects: CESI RICERCA DER Test Facility". [Online] Available: [www.microgrids.eu/index.php?page=kythnos&id=6](http://www.microgrids.eu/index.php?page=kythnos&id=6)

Report generated on: 12-08-2009 at : 01:54:35

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in*

*favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 1 2. GE Microgrid demo Department of Energy (DOE), GE Global Research, GE Energy (NRPS), GE C&I (Multilin), Rocky Research and National Renewable Energy Laboratory, "Microgrid Design, Development & Demonstration," March 2006.

Report generated on: 12-08-2009 at : 03:33:44

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 1-3. Microgrid architecture diagram A. Akhil, R. Lasseter, C. Marnay, J. Stephens, J. Dagle, R. Guttromson, A. Sakis Meliopoulos, R. Yinger, and J. Eto, "Integration of Distributed Energy Resources: The CERTS Microgrid Concept," Energy Systems Integration Program, Public Interest Energy Research, California Energy Commission, 2002.

Report generated on: 12-08-2009 at : 03:36:48

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

## **Virginia Tech ETD Fair Use Analysis Results**

***This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.***

Name: Wencong Su

Description of item under review for fair use: Figure 2-17. The block diagram of Micro-turbine generation system A. Al-Hinai and A. Feliachi, "Dynamic Model Of A Microturbine Used As A Distributed Generator," in 34th Southeastern Symposium on system Theory, Huntsville, Alabama, pp. 209-213, March, 2002.

Report generated on: 12-08-2009 at : 03:38:57

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the



market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 2-22. The block diagram of the temperature controller in MGT S. R. Guda, C. Wang and M. H. Nehrir, "A Simulink-based microturbine model for distributed generation studies," 37th North American Power Symposium, Proceedings, pp. 269-274, 2005.

Report generated on: 12-08-2009 at : 03:40:40

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 2-24. The working principle of MGT. Source: S. R. Guda, C. Wang and M. H. Nehrir, "A Simulink-based microturbine model for distributed generation studies," 37th North American Power Symposium, Proceedings, pp. 269-274, 2005.

Report generated on: 12-08-2009 at : 03:42:21

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

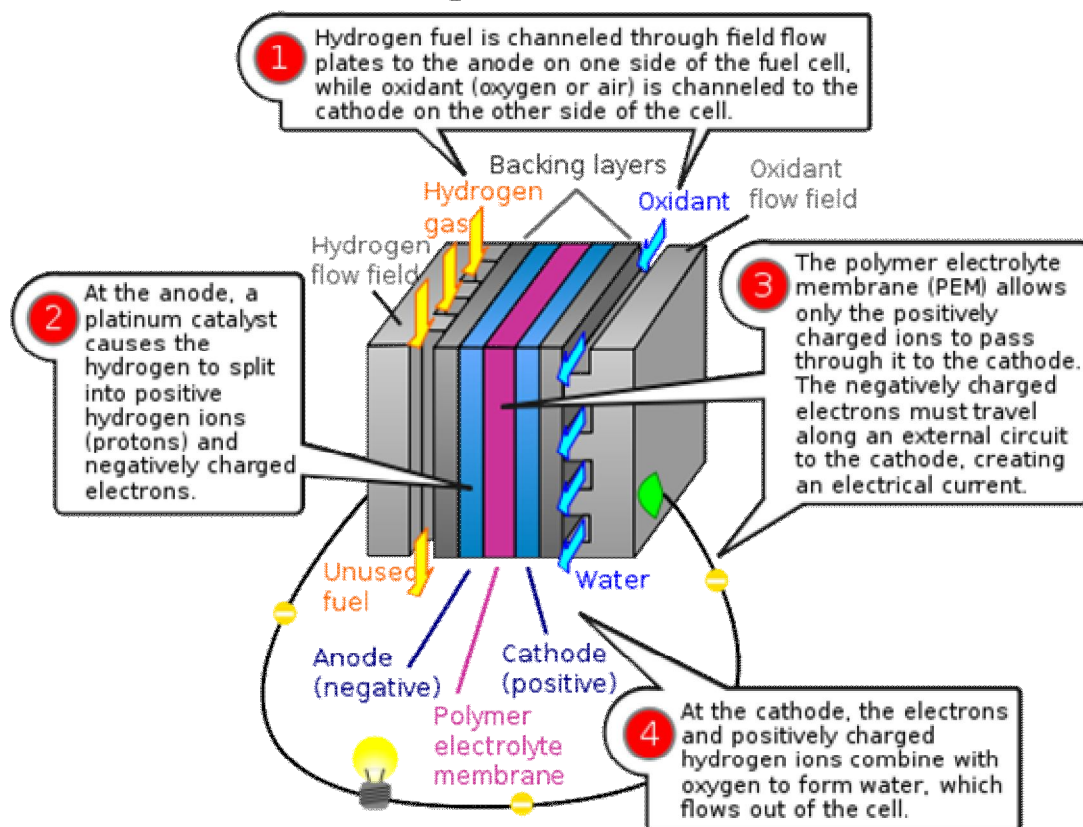


# File:PEM fuelcell.svg

From Wikipedia, the free encyclopedia

- File
- File history
- File links

## Proton exchange membrane fuel cell



PEM\_fuelcell.svg (SVG file, nominally 550 × 450 pixels, file size: 41 KB)

This image rendered as PNG in other sizes: 200px, 500px, 1000px, 2000px.

## Summary

Image description of Proton exchange membrane fuel cell. Intended to replace raster version.

File size is almost two times the original GIF file. It probably needs a lot of touching up as well as optimization.

## Licensing

*I, the copyright holder of this work, hereby release it into the **public***



*domain. This applies worldwide.*

In case this is not legally possible,

*I grant any entity the right to use this work **for any purpose**, without any conditions, unless such conditions are required by law.*

## Now commons

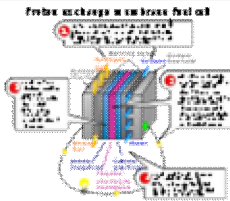
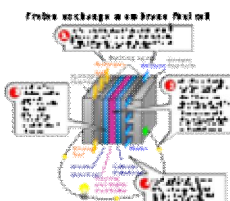
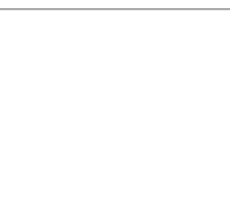


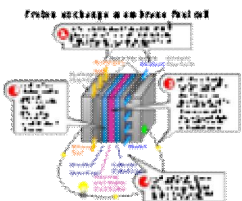
This file is now available on **Wikimedia Commons** as **File:PEM fuelcell.svg**.

Files that have been tagged with this template may be deleted after satisfying conditions of CSD F8. Administrators: delete this file.

## File history

Click on a date/time to view the file as it appeared at that time.

	Date/Time	Thumbnail	Dimensions	User	Comment
current	04:07, 23 August 2008		550×450 (41 KB)	Jafet (talk   contribs)	
	12:44, 22 July 2007		550×450 (41 KB)	Jafet (talk   contribs)	(Details of a Proton exchange membrane fuel cell. Intended to replace raster version. File size is almost two times the original GIF file. It probably needs a lot of touching up as well as optimization.)
	12:28, 22 July 2007		550×450 (41 KB)	Jafet (talk   contribs)	(Image description of Proton exchange membrane fuel cell. Intended to replace raster version. File size is almost two

				times the original GIF file. It probably needs a lot of touching up as well as optimization.)
--	--	---	--	---

- Edit this file using an external application See the setup instructions for more information.

## File links

The following pages on the English Wikipedia link to this file (pages on other projects are not listed):

- Fuel cell
- File:Fuel cell still.gif

Retrieved from "[http://en.wikipedia.org/wiki/File:PEM\\_fuelcell.svg](http://en.wikipedia.org/wiki/File:PEM_fuelcell.svg)"

Categories: [User-created public domain images from July 2007](#) | [All user-created public domain images](#) | [Fuel cells](#) | [Wikipedia files with the same name on Wikimedia Commons](#)

---

- This page was last modified on 5 December 2009 at 23:53.
- Text is available under the Creative Commons Attribution-ShareAlike License; additional terms may apply. See Terms of Use for details.  
Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., a non-profit organization.
- Contact us



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 2-34. The working principle of DFIG. Source: M. Seyedi, "Evaluation of the DFIG Wind Turbine Built-in Model in PSS/E," Master of Science Thesis, the Programme of Electric Power Engineering, Division of Electric Power Engineering, Department of Environment and Energy, Chalmers University of Technology, Göteborg, 2009.

Report generated on: 12-08-2009 at : 04:16:21

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 2-41. The equivalent circuit of the rechargeable battery. Source: O. Tremblay, L. A. Dessaint and A. I. Dekkiche, "A generic battery model for the dynamic simulation of Hybrid Electric Vehicles," 2007 Ieee Vehicle Power and Propulsion Conference, Vols 1 and 2, pp. 284-289

Report generated on: 12-08-2009 at : 04:18:41

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

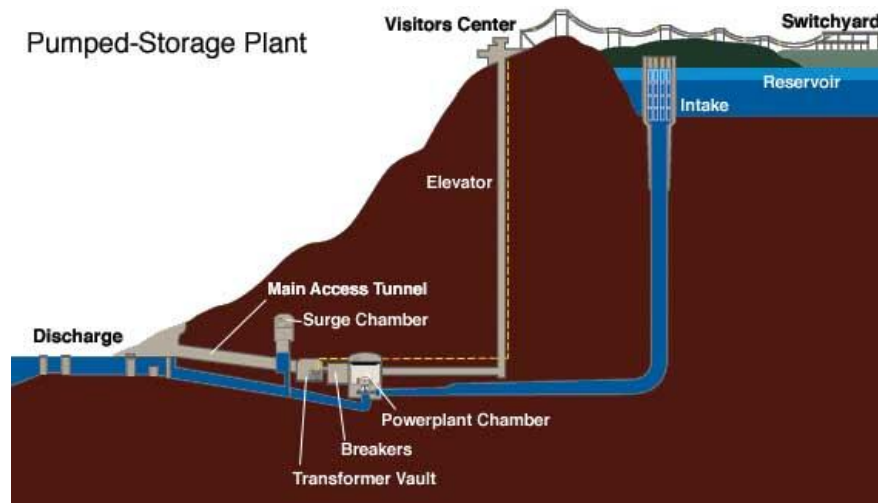


# File:Pumpstor racoon mtn.jpg



From Wikipedia, the free encyclopedia

- File
- File history
- File links



No higher resolution available.

Pumpstor\_racoon\_mtn.jpg (569 × 326 pixels, file size: 16 KB, MIME type: image/jpeg)



This is a file from the Wikimedia Commons. The description on its **description page there** is shown below. Commons is a freely licensed media file repository. You can help.

Transwiki approved by: w:en>User:Dmcdevit

This image was copied from wikipedia:en. The original description was:

Pumped Storage diagram at TVA's Racoon mountain

This image comes from: <http://www.tva.gov/power/pumpstorart.htm>

As a US government organization, no copyright is claimed

Pud 17:57, 7 Jul 2004 (UTC)



*This image is a work of a United States Tennessee Valley Authority employee, taken or made during the course of the person's official duties. As a work of the U.S. federal government, the image is in the **public domain**.*



**JPEG**

This image was (or all images in this article or category were) uploaded in the **JPEG format**.

However, it contains information that could be stored more efficiently or more accurately in the PNG format or SVG format. If possible, please upload a PNG or SVG version of this image without compression artifacts, derived from a non-JPEG source or with existing artifacts removed.

Català | Český | Deutsch | English | Español | Suomi | Français | עברית | 日本語 | Македонски | Plattdüütsch | Português | Русскыи | +/-

## File history


date/time	username	resolution	size	edit summary
17:54, 7 July 2004	w:en>User:Pud	569×326	16 KB	Pumped Storage diagram at TVA's Racoon mountian

## Image description page history

link	date/time	username	edit summary
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=91432433	05:02, 11 September 2007	w:en>User:Dmcdevit	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=91432433	19:17, 1 December 2006	w:en>User:67.153.59.162	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=88235943	17:19, 16 November 2006	w:en>User:Ahoerstemeier	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=88201809	13:47, 16 November 2006	w:en>User:208.108.154.8	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=57413570	20:37, 7 June 2006	w:en>User:CmdrObot	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=37044283	04:49, 28 January 2006	w:en>User:Berkut	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=27163188	14:02, 2 November 2005	w:en>User:Sillybilly	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=25748886	16:25, 17 October 2005	w:en>User:142.227.231.193	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=16600059	21:44, 17 May 2005	w:en>User:ChrisRuvolo	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=13852711	06:22, 15 December 2004	w:en>User:Evil Monkey	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=8449187	17:57, 7 July 2004	w:en>User:Duk	
http://en.wikipedia.org/w/index.php?title=Image:Pumpstor_racoon_mtn.jpg&redirect=no&oldid=4493389	17:54, 7 July 2004	w:en>User:Duk	(Pumped Storage diagram at TVA's Racoon mountian)

## File history

Click on a date/time to view the file as it appeared at that time.

	Date/Time	Thumbnail	Dimensions	User	Comment
current	14:44, 13 September 2007		569×326 (16 KB)	BetacommandBot	(Transwiki approved by: w:en>User:Dmcdevit This image was copied from wikipedia:en. The original description was: Pumped Storage diagram at TVA's Racoon mountain This image comes from: http://www.tva.gov/power/pumpstorart.htm As a US government org)

## File links

The following pages on the English Wikipedia link to this file (pages on other projects are not listed):

- Pumped-storage hydroelectricity
- Wind power
- Wikipedia:Changing attribution for an edit/Old log 8
- User talk:Super1
- Raccoon Mountain Pumped-Storage Plant
- Wind power grid integration

Retrieved from "[http://en.wikipedia.org/wiki/File:Pumpstor\\_racoon\\_mtn.jpg](http://en.wikipedia.org/wiki/File:Pumpstor_racoon_mtn.jpg)"

---

**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 3-11. Electrical circuit of non-linear supercapacitor model implemented in PLECS. Source: P. Johansson and B. Andersson, "Comparison of Simulation Programs for Supercapacitor Modelling," Master of Science, Department of Energy and Environment, Chalmers University of Technology, Gothenburg, Sweden, 2008.

Report generated on: 12-08-2009 at : 04:24:50

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the



market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 3-12. PLECS implementation of PV string model as a non-linear current source. Source: J. Schonberger, "A single phase multi-string PV inverter with minimal bus capacitance," presented at the Power Electronics and Applications, 2009. EPE '09. 13th European Conference Barcelona, Spain, 2009.

Report generated on: 12-08-2009 at : 04:26:50

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 3-2. RT-LAB Single Target Configuration. Source: "RT-LAB Professional Overview," Opal-RT, (Cited on Oct 10, 2009) [Online] Available: <http://www.opal-rt.com/product/rt-lab-professional>

Report generated on: 12-08-2009 at : 04:22:05

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 3-3. RT-LAB Distributed Target Configuration. Source: "RT-LAB Professional Overview," Opal-RT, (Cited on Oct 10, 2009) [Online] Available: <http://www.opal-rt.com/product/rt-lab-professional>

Report generated on: 12-08-2009 at : 04:23:14

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 4-1. Geographical Map of Ontario, Canada. Source: "Map of Ontario, Canada," [Online] Available: <http://ontario.alarmforce.com/blog/wp-content/uploads/ontario.jpg>

Report generated on: 12-08-2009 at : 04:28:05

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in*



*favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 5-1. Simplified effect of DR on electricity market price. Source: M. Fahrioglu and F. L. Alvarado, "Designing incentive compatible contracts for effective demand management," Ieee Transactions on Power Systems, vol. 15, pp. 1255-1260, Nov 2000.

Report generated on: 12-08-2009 at : 04:29:33

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 6-1. A simplified Microgrid diagram with relay protection.  
Source: H. Nikkhajoei and R. H. Lasseter, "Microgrid protection," 2007 Ieee Power Engineering Society General Meeting, Vols 1-10, pp. 2123-2128, 2007

Report generated on: 12-08-2009 at : 04:31:00

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***



**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

(Please ensure that Javascript is enabled on your browser before using this tool.)

# Virginia Tech ETD Fair Use Analysis Results

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Wencong Su

Description of item under review for fair use: Figure 6-2. CO-8 time-delay overcurrent relay characteristics (Courtesy of Westinghouse Electric Corporation). Source: J. D. Glover and M. S. Sarma, Power System Analysis and Design, 3rd ed.: Thomson-Engineering, Dec 2002.

Report generated on: 12-08-2009 at : 04:32:03

## **Based on the information you provided:**

### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

### **Factor 4**

Your consideration of the effect or potential effect on the

market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

